

We claim:

1. A method for forming a self-degrading filter cake in a subterranean formation, comprising the steps of:

placing a well drill-in and servicing fluid in a subterranean formation, the well drill-in and servicing fluid comprising a viscosified fluid, a fluid loss control additive, and a bridging agent comprising a degradable material; and

forming a self-degrading filter cake comprising the bridging agent within the formation.

2. The method of claim 1 wherein the step of forming a self-degrading filter cake within the formation comprises forming the filter cake upon the face of the formation itself, upon a sand screen, or upon a gravel pack.

3. The method of claim 1 wherein the degradable material comprises a degradable polymer or a dehydrated compound.

4. The method of claim 3 wherein the degradable polymer comprises polysaccharides, chitins, chitosans, proteins, orthoesters, aliphatic polyesters, poly(glycolides), poly(lactides), poly(ϵ -caprolactones), poly(hydroxybutyrates), polyanhydrides, aliphatic polycarbonates, poly(orthoesters), poly(amino acids), poly(ethylene oxides), or polyphosphazenes.

5. The method of claim 1 wherein the degradable material further comprises a plasticizer or a stereoisomer of a poly(lactide).

6. The method of claim 3 wherein the dehydrated compound comprises anhydrous sodium tetraborate or anhydrous boric acid.

7. The method of claim 1 wherein the degradable material comprises poly(lactic acid) and a compound chosen from the group consisting of sodium borate, boric oxide, calcium carbonate, and magnesium oxide.

8. The method of claim 7 wherein the poly(lactic acid) is present in the degradable material in a stoichiometric amount.

9. The method of claim 1 wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in an amount sufficient to create an efficient filter cake.

10. The method of claim 1 wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in an amount sufficient to provide a fluid loss of less than about 15 mL per API Recommended Practice 13.

11. The method of claim 1 wherein the degradable material has a particle size distribution in the range of from about 0.1 micron to about 1.0 millimeter.

12. The method of claim 1 wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in an amount in the range of from about 0.1% to about 30% by weight.

13. The method of claim 1 wherein the viscosified fluid comprises a viscosifier.

14. The method of claim 1 wherein the viscosified fluid comprises a viscosifier; wherein the viscosifier is present in the well drill-in and servicing fluid in an amount in the range of from about 0.13% to about 0.16% by weight; wherein the viscosifier is xanthan; wherein the fluid loss control additive is present in the well drill-in and servicing fluid in an amount in the range of from about 1% to about 1.3% by weight; wherein the fluid loss control additive is starch; wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in the range of from about 1% to about 5% by weight; and wherein the degradable material comprises poly(lactic acid) and either calcium carbonate or magnesium oxide.

15. A method of drilling an open hole in a subterranean formation, comprising the steps of:

circulating through the drill pipe and drill bit a well drill-in and servicing fluid comprising a viscosified fluid, a fluid loss control additive, and a bridging agent comprising a degradable material;

forming a self-degrading filter cake comprising the bridging agent within the formation; and

permitting the filter cake to self-degrade.

16. The method of claim 15 wherein the step of forming a self-degrading filter cake comprises forming the filter cake upon the face of the formation itself, upon a sand screen, or upon a gravel pack.

17. The method of claim 15 wherein the step of permitting the filter cake to self-degrade comprises contacting the filter cake with a degrading agent for a period of time such that the bridging agent is dissolved thereby.

18. The method of claim 17 wherein the well drill-in and servicing fluid comprises the degrading agent.

19. The method of claim 17 wherein the bridging agent comprises the degrading agent.

20. The method of claim 17 wherein the degrading agent comprises water.

21. The method of claim 15 wherein the degradable material comprises a degradable polymer or a dehydrated compound.

22. The method of claim 21 wherein the degradable polymer comprises polysaccharides, chitins, chitosans, proteins, orthoesters, aliphatic polyesters, poly(glycolides), poly(lactides), poly(ϵ -caprolactones), poly(hydroxybutyrates), polyanhydrides, aliphatic polycarbonates, poly(orthoesters), poly(amino acids), poly(ethylene oxides), or polyphosphazenes.

23. The method of claim 15 wherein the degradable material comprises a plasticizer.

24. The method of claim 21 wherein the dehydrated compound comprises anhydrous sodium tetraborate or anhydrous boric acid.

25. The method of claim 15 wherein the degradable material comprises a stereoisomer of a poly(lactide).

26. The method of claim 15 wherein the degradable material comprises poly(lactic acid) and a compound chosen from the group consisting of sodium borate, boric oxide, calcium carbonate, and magnesium oxide.

27. The method of claim 26 wherein the poly(lactic acid) is present in a stoichiometric amount.

28. The method of claim 15 wherein the degradable material has a particle size distribution in the range of from about 0.1 micron to about 1.0 millimeter.

29. The method of claim 15 wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in an amount sufficient to create an efficient filter cake.

30. The method of claim 29 wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in an amount in the range of from about 0.1% to about 30% by weight.

31. The method of claim 15 wherein the viscosified fluid comprises a viscosifier; wherein the viscosifier is present in the well drill-in and servicing fluid in an amount in the range of from about 0.13% to about 0.16% by weight; wherein the viscosifier is xanthan; wherein the fluid loss control additive is present in the well drill-in and servicing fluid in an amount in the range of from about 1% to about 1.3% by weight; wherein the fluid loss control additive is starch; wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in the range of from about 1% to about 5% by weight; and wherein the degradable material comprises poly(lactic acid) and either calcium carbonate or magnesium oxide.

32. A method of degrading a filter cake in a subterranean formation, the filter cake having been deposited therein by a well drill-in and servicing fluid comprising a bridging agent, comprising the step of:

utilizing a bridging agent comprising a degradable material; and

contacting the degradable material with a degrading agent for a period of time such that the degradable material is dissolved thereby.

33. The method of claim 32 wherein the bridging agent comprises the degrading agent.

34. The method of claim 32 wherein the degrading agent is supplied by a well drill-in and servicing fluid.

35. The method of claim 32 wherein the degrading agent comprises water.

36. The method of claim 32 wherein the degradable material comprises a degradable polymer or a dehydrated compound.

37. The method of claim 36 wherein the degradable polymer comprises polysaccharides, chitins, chitosans, proteins, orthoesters, aliphatic polyesters, poly(glycolides), poly(lactides), poly(ϵ -caprolactones), poly(hydroxybutyrates), polyanhydrides, aliphatic polycarbonates, poly(orthoesters), poly(amino acids), poly(ethylene oxides), or polyphosphazenes.

38. The method of claim 32 wherein the degradable material further comprises a plasticizer.

39. The method of claim 36 wherein the dehydrated compound comprises anhydrous sodium tetraborate or anhydrous boric acid.

40. The method of claim 32 wherein the degradable material comprises a stereoisomer of a poly(lactide).

41. The method of claim 32 wherein the degradable material comprises poly(lactic acid) and a compound chosen from the group consisting of sodium borate, boric oxide, calcium carbonate, and magnesium oxide.

42. The method of claim 41 wherein the poly(lactic acid) is present in the degradable material in a stoichiometric amount.

43. The method of claim 32 wherein the degradable material has a particle size distribution in the range of from about 0.1 micron to about 1.0 millimeter.

44. The method of claim 32 wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in an amount sufficient to create a desirable number of voids in the filter cake.

45. The method of claim 44 wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in an amount of about 0.1% to about 30% by weight.

46. The method of claim 32 wherein the well drill-in and servicing fluid comprises a viscosified fluid and a fluid loss control additive; wherein the viscosified fluid comprises a viscosifier; wherein the viscosifier is present in the well drill-in and servicing fluid in an amount in the range of from about 0.13% to about 0.16% by weight; wherein the viscosifier is xanthan; wherein the fluid loss control additive is present in the well drill-in and servicing fluid in an amount in the range of from about 1% to about 1.3% by weight; wherein the fluid loss control additive is starch; wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in the range of from about 1% to about 5% by weight; and wherein the degradable material comprises poly(lactic acid) and either calcium carbonate or magnesium oxide.

47. A well drill-in and servicing fluid comprising:
a viscosified fluid;
a fluid loss control additive; and
a bridging agent comprising a degradable material.
48. The well drill-in and servicing fluid of claim 47 wherein the degradable material comprises a degradable polymer or a dehydrated compound.
49. The well drill-in and servicing fluid of claim 48 wherein the degradable polymer comprises polysaccharides, chitins, chitosans, proteins, orthoesters, aliphatic polyesters, poly(glycolides), poly(lactides), poly(ϵ -caprolactones), poly(hydroxybutyrates), polyanhydrides, aliphatic polycarbonates, poly(orthoesters), poly(amino acids), poly(ethylene oxides), or polyphosphazenes.
50. The well drill-in and servicing fluid of claim 47 wherein the degradable material comprises a plasticizer.
51. The well drill-in and servicing fluid of claim 48 wherein the dehydrated compound comprises anhydrous sodium tetraborate or anhydrous boric acid.
52. The well drill-in and servicing fluid of claim 47 wherein the degradable material comprises a stereoisomer of a poly(lactide).
53. The well drill-in and servicing fluid of claim 47 wherein the degradable material comprises poly(lactic acid) and a compound chosen from the group consisting of sodium borate, boric oxide, calcium carbonate, and magnesium oxide.
54. The well drill-in and servicing fluid of claim 53 wherein the poly(lactic acid) is present in a stoichiometric amount.
55. The well drill-in and servicing fluid of claim 47 wherein the degradable material has a particle size distribution in the range of from about 0.1 micron to about 1.0 millimeter.
56. The well drill-in and servicing fluid of claim 47 wherein the viscosified fluid is present in the well drill-in and servicing fluid in an amount in the range of from about 68% to about 99% by weight.
57. The well drill-in and servicing fluid of claim 47 wherein the viscosified fluid comprises water, oil, or a mixture thereof.
58. The well drill-in and servicing fluid of claim 47 wherein the viscosified fluid comprises a viscosifier.

59. The well drill-in and servicing fluid of claim 58 wherein the viscosifier is present in the well drill-in and servicing fluids of the present invention in an amount sufficient to suspend the bridging agent in the well drill-in and servicing fluid for a desired period of time.

60. The well drill-in and servicing fluid of claim 58 wherein the viscosifier is present in the well drill-in and servicing fluids of the present invention in an amount in the range of from about 0.01% to about 0.6% by weight.

61. The well drill-in and servicing fluid of claim 58 wherein the viscosifier comprises a biopolymer, a cellulose derivative, guar, or a guar derivative.

62. The well drill-in and servicing fluid of claim 61 wherein the viscosifier is xanthan.

63. The well drill-in and servicing fluid of claim 47 wherein the fluid loss control additive is present in the well drill-in and servicing fluid in an amount sufficient to provide a desired degree of fluid loss control.

64. The well drill-in and servicing fluid of claim 47 wherein the fluid loss control additive is present in the well drill-in and servicing fluid in an amount in the range of from about 0.01% to about 2% by weight.

65. The well drill-in and servicing fluid of claim 47 wherein the fluid loss control additive comprises starch, starch ether derivatives, hydroxyethylcellulose, cross-linked hydroxyethylcellulose, or mixtures thereof.

66. The well drill-in and servicing fluid of claim 47 wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid in an amount sufficient to create a desirable number of voids in the filter cake.

67. The well drill-in and servicing fluid of claim 47 wherein the bridging agent comprising the degradable material is present in the well drill-in and servicing fluid ranging from about 0.1% to about 30% by weight.

68. The well drill-in and servicing fluid of claim 47 wherein the viscosified fluid comprises a viscosifier; wherein the viscosifier is present in the well drill-in and servicing fluids of the present invention in an amount in the range of from about 0.13% to about 0.16% by weight; wherein the viscosifier is xanthan; wherein the fluid loss control additive is present in the well drill-in and servicing fluid in an amount in the range of from about 1% to about 1.3% by weight; wherein the fluid loss control additive is starch; wherein the bridging agent comprising

the degradable material is present in the well drill-in and servicing fluid in the range of from about 1% to about 5% by weight; and wherein the degradable material comprises poly(lactic acid) and either calcium carbonate or magnesium oxide.

69. A bridging agent comprising a degradable material.
70. The bridging agent of claim 69 wherein the degradable material comprises a degradable polymer or a dehydrated compound.
71. The bridging agent of claim 70 wherein the degradable polymer comprises polysaccharides, chitins, chitosans, proteins, orthoesters, aliphatic polyesters, poly(glycolides), poly(lactides), poly(ϵ -caprolactones), poly(hydroxybutyrates), polyanhydrides, aliphatic polycarbonates, poly(orthoesters), poly(amino acids), poly(ethylene oxides), or polyphosphazenes.
72. The bridging agent of claim 69 wherein the degradable material further comprises a plasticizer.
73. The bridging agent of claim 70 wherein the dehydrated compound comprises anhydrous sodium tetraborate or anhydrous boric acid.
74. The bridging agent of claim 69 wherein the degradable material comprises a stereoisomer of a poly(lactide).
75. The bridging agent of claim 69 wherein the degradable material comprises poly(lactic acid) and a compound chosen from the group consisting of sodium borate, boric oxide, calcium carbonate, and magnesium oxide.
76. The bridging agent of claim 75 wherein the poly(lactic acid) is present in the degradable material in a stoichiometric amount.
77. The bridging agent of claim 69 wherein the degradable material has a particle size distribution in the range of from about 0.1 micron to about 1.0 millimeter.
78. The bridging agent of claim 69 further comprising a degrading agent.
79. The bridging agent of claim 78 wherein the degrading agent comprises a source of releasable water.
80. The bridging agent of claim 79 wherein the degrading agent comprises sodium acetate trihydrate, sodium borate decahydrate, sodium carbonate decahydrate, or a mixture thereof.
81. The bridging agent of claim 78 wherein the degrading agent is present in a stoichiometric amount.